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VARIETY VARIATIONS IN NEW AND EXISTING
U OF S SOUR CHERRIES

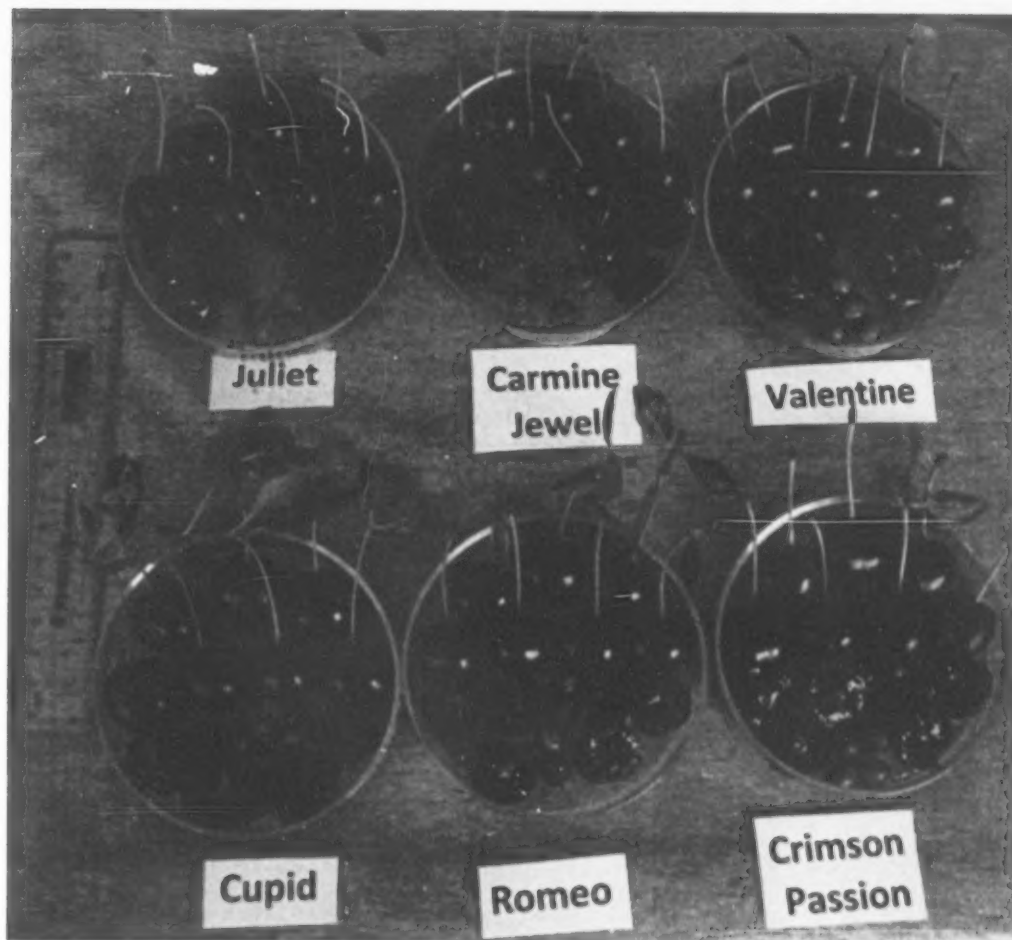
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VARIATIONS IN NEW AND EXISTING U of S Sour Cherries

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(a) Abstract/Summary

Six varieties and 10 advanced selections developed at the University of Saskatchewan were tracked during the ripening process with a goal of determining the optimum harvest time for high quality fruit and high yields. Fruit was photographed and evaluated each week for 6 weeks. A DSLR camera with color correction charts and photographic imaging programs were used to document the colour changes. Colours were then incorporated into harvest index cards to be used by growers to assist them in determining the best time to harvest. Other data tracked each week was: juice colour, sugar content (brix), pH, total acidity, fruit weight, pit weight. Flesh / pit ratios and sugar/acid ratios were computed from the data.

Processing experiments focused on dried cherries, frozen cherries and juice as these were of major interest to the Canadian Cherry Producers Association. Previous marketing studies also suggested these areas were most important. Flavour of fruit and other quality attributes, after being frozen and thawed, were evaluated by a panel of 9 food scientists and processors who made general recommendations for uses of each variety. Protocols and recipes were developed for non-sweetened dried cherries, sugar infused dried cherries, cherry beef jerky, and muffins. Products produced were further evaluated and subjected to taste panels. Much data was accumulated in both the ripening and the processing experiments which would benefit processors interested in juice manufacture.

Comparison of advanced selections with the named varieties revealed 2 advanced selections with superior attributes that warrant further study. The details learned about the existing varieties will be useful in selecting superior varieties in the future.

Despite the cool wet season, the U of SK cherries were found to have higher sugar content than the more widely grown 'Montmorency' common in warmer areas of North America. Samples of cherry varieties gathered in previous years were also evaluated to give perspective to this year's data.

A 'Draft Standards for Saskatchewan Cherries' table was created that would utilize the colour guides and fruit data produced in this project. It was recommended that the Cherry Producers use the colour guides to pick at peak harvest times and compare their fruit quality to the draft standards to see if the proposed standards are reasonably attainable and if the higher grades are a reflection of the best quality possible.

(b) Introduction – Brief project background, rationale and objectives

There are 6 varieties of dwarf sour cherries developed by the University of SK and being grown in Saskatchewan. These varieties have their own special characteristics which may not be fully appreciated by newer growers and consumers. Most of the University of SK's cherries are darker with higher sugar content and more flavour than the more familiar 'Montmorency' variety. 'Montmorency' is practically the only sour cherry grown in the USA, BC and ON. But U of SK sour cherries are only superior if allowed to fully ripen. A common mistake of new growers is to harvest 'Carmine Jewel' cherries while they are still red, instead of waiting for much higher quality fruit when they are black. A key part of this project is to track the U of SK varieties through the growing season, measuring colour and fruit quality so that growers will know when to harvest their fruit. In addition to the 6 named varieties, this study will also involve 10 advanced selections that will be further evaluated.

Previous data of U of S cherries was based on the original trees grown at a very high density per acre in a breeding setting. These varieties have been replicated and grown at proper spacing for mechanized field harvesting similar to methods being used by most growers. The data from this project will be more exacting scientifically and consistent with what can be expected by growers. (SAFRR 20020173-09AC)

Earlier studies by the U of S centered on fresh fruit evaluations and taste tests. Suitability of each variety for processing was not fully possible because of limited quantities of fruit produced each year by a single tree. With 40 trees of each variety it will be possible to test many end uses in the same season.

Since the 'Dwarf Sour Cherries: a guide for commercial production' (Bors & Matthews, 2004) was written, many more growers are in production and are considering a broader range of sites and end products. This project will facilitate the development of end products in the marketplace.

The objectives of this project are:

1. Develop quality standards for sour cherry production and processing. This will serve as a bridge between researchers, producers and the marketplace.
2. Quantify variations among varieties of U of S Sour Cherries, existing and upcoming
3. The widely planted variety 'Carmine Jewel' will be used as a benchmark variety to compare to other varieties. This will serve as a bridge between researchers, producers and the marketplace
4. Understand differences among varieties especially for suitable end-uses.
5. Create guidelines for growers to harvest when fruit is at optimal quality.

(c) General Methods

The cherries used in this project were grown at the University of Saskatchewan Horticulture Farm in Saskatoon.

There were 2 sets of cherries in adjacent fields: named varieties & unnamed advanced selections. Each of the 6 named varieties was in separate rows consisting of 40 bushes. The separate rows facilitated mechanical harvesting of fruit. The rows ran north and south and the 4 reps were the relative positions within each row: NW, NE, SW & SE. These bushes were 6 years old. The unnamed advanced selections were sampled similarly but there were only 10 bushes of each of these. Also the advanced selections were only 5 years old. But both fields had 'Carmine Jewel' (our 1st variety released in 1999) planted for comparison. The 10 most productive 'Advanced Selections' were used extensively in this study.

Fruit harvested for processing experiments was washed, cooled, mechanically pitted with a 'Dunkley' pitter, and frozen in a -40°C freezer the same day. For some varieties we used fruit harvested in previous years.

Table 1. Lab equipment used in the ripeness study

Instrument	Make	Model	Country of Manufacture
Fruit Juice Titratable Acidity	Hanna Instruments	HI 84432	Hungary
pH probe	Hanna Instruments	HI 1131	Hungary
Pocket Refractometer	Atago	PAL-α	Japan
Balance	Sartorius	BP221s	Germany
White Balance			
Photography Software and Colour Card	x-rite	ColorChecker Passport	USA
Digital SLR Camera	Sony	DSLR-A200	Japan

Ripeness Study

Cherry fruit of seventeen dwarf sour cherry varieties were picked weekly during the summer of 2010. The first picking date was July 21 and picking continued every Wednesday until August 25. Only the named varieties were picked on August 25 as most of the cherries were deemed over-ripe at that time. Picking was done by splitting each variety of bushes into quadrants (North-east, south

east, south west and north west). Enough fruit to fill a 250ml container was picked from each quadrant where fruit was plentiful. If the bushes were not productive approximately 15 cherries were picked from each quadrant. Immediately after picking the fruit was photographed on a light table using natural light and then taken to a freezer that runs at a constant minus forty degrees Celsius.

During the fall (late September and early October) various quantitative tests were conducted. First thing in the morning one box of fruit (containing 36 samples) was taken out of the minus forty and the samples in their plastic containers were placed in hot water in the sink to thaw for about an hour. One sample at a time was removed from the hot water and was tested. First ten cherries were weighed. These cherries were then hand pitted and the pitted were weighed. The pitted fruit was then squished so juice came out. A small portion of the juice was placed into a digital refractometer and the degree Brix was recorded. Ten millilitres of juice was measured out in a cylinder and then placed in a small beaker. The pH was measured using Hanna instruments H184432 Fruit Juice Titratable Acidity meter. Then the ten millilitres of juice was transferred into a small petri dish. This dish was placed on the measuring plate of the colourimeter and the L, a and b values were recorded. This juice was transferred into a small plastic container and photos were taken of the juice once all four quadrants were assessed. The juice was placed into the freezer until all the samples had been tested.

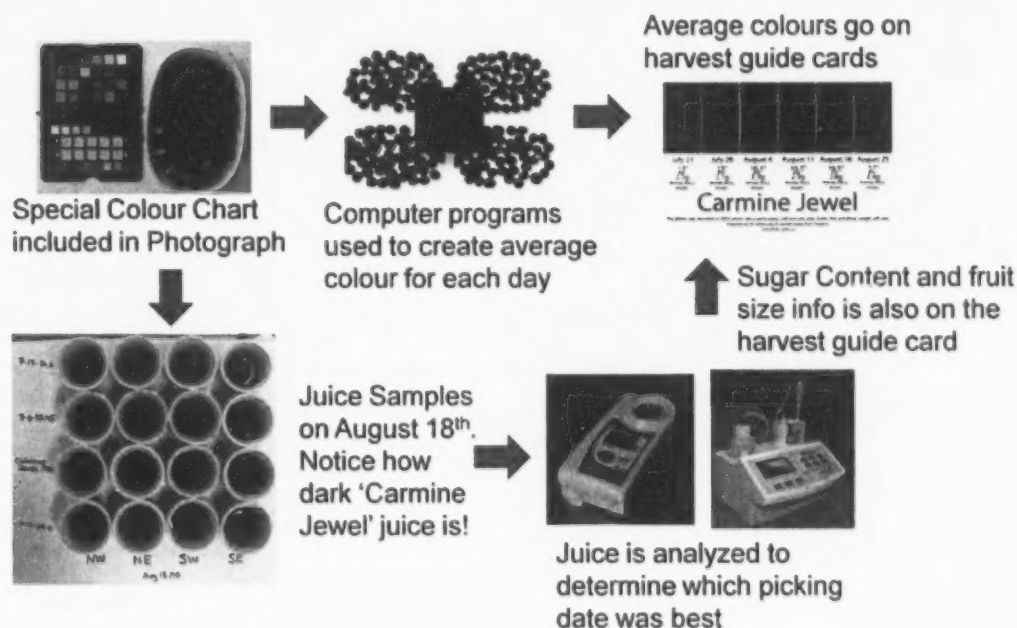


Figure 1. Flowchart for Cherry Ripeness Study. 4 samples of 16 genotypes were harvested each week, photographed and had analysis done. A colourimeter was also used on the juice but a picture of that equipment was not available.

Once all of the juice had been assessed the titratable acidity was calculated. This was done using the aforementioned machine. Two millilitres of juice was placed in a beaker and then forty eight milliliters of water was added. This was placed in the machine and it calculated the percent malic acid in the cherry juice. Once all of the juice had been tested photos of juice from each week for a single variety was photographed together and then re-frozen.

The pictures that were taken during the picking period were analyzed through November. The goal was to figure out the average colour of the cherries and then average the four quadrants together to get an overall average of that variety at that specific picking time. In the end the hope was to create a type of colour wheel that would dictate at which colour the cherries were at their optimum ripeness. Firstly a camera profile was created by uploading a picture of the colour checker passport into the program. This picture needed to be a dng file so raw pictures were changed to dng using adobe's dng converter program. The camera profile was saved and used in photoshop. A new profile was created for each week. Then using the profile for the appropriate week the original cherry pictures were opened in Photoshop and the white balance was adjusted to compensate for the shade. Then each picture was cropped so that only the cherries were in the picture. Then using the colour range tool the shadows in between the cherries were removed. When the process was complete only the cherries remained on a white background. All of the pictures were saved as jpgs. Once all of the pictures had been cropped they were one at a time uploaded to <http://whatsitscolor.com/>. Once this program spit out the average colour the print screen keyboard function was used to copy the colour into the paint program. The colour was cropped out of the print screen shot and placed in a new document. This process was repeated for the remaining three quadrants. All four of the average colours were placed in the same paint file and once again saved as a jpg. This was repeated for all of the varieties and all of the picking dates. Once this was completed the jpg with all four quadrants was uploaded to the same website and the average colour for the variety at that picking date was copied into another paint file and saved as a jpg. Once the average colour for all the varieties at all of the dates was finalized they were placed into an excel file which showed the colour progression through the season.

Quantitative data was also collected on the six named varieties from the last three years in an attempt to see the differences growing conditions make. The data was taken in a similar way as to the ripeness study. Ten cherries were weighed out then pitted if they were not pitted already. Then the cherries were juiced and the juice was used to test the brix, acidity and colour. The same machines as the above process were used.

Freeze Thaw Test

For this test one litre containers of the numbered varieties from the ripeness study as well as containers of each of the named varieties from the last three years were removed from the minus forty freezer and weighed. For some varieties there was no fruit for this test so the test was

conducted on the fruit that was available. Once the fruit had its frozen weight recorded the cherries were left in the fridge over night to thaw. They were then drained and the weight of the thawed cherries was recorded. These cherries were then dried and the weight was recorded again. All of this data was put into an excel spreadsheet.

Canned Cherry Tests

Cherries that had been canned the previous winter were evaluated in December 2010. Ten cherries from each can were weighed and then evaluated for amount of cracking. Amount of cracking was measured by looking at a sample of ten cherries and counting the number of cherries that had cracked in places other than the pitting wound. This was recorded as a number out of ten which was converted to a percent (ie: 4 out of 10 cherries were cracked equals 40 percent cracked). These cherries were juiced and a sample of juice was placed in the refractometer and ten millilitres was measured and placed into a small beaker. The pH was measured and then the juice was transferred to a petri dish and the colour was recorded. Whole cherries were also placed into a petri dish and measured for colour in the same manner as the juice was. Flavour was also recorded. One cherry was sampled and rated on a letter scale (A being best, E being worst). The samples were then taken to the food centre where the texture was measured. This was done by using a TMS-90 Texture Test System with a CS-1 attachment. Fifty-five grams of cherries were weighed out and placed into the plate of the CS-1 attachment. The cherries were spread out evenly to cover the entire bottom. The machine was run and the maximum force was recorded. The same varieties that were canned were also tested in frozen form. These cherries were removed from the minus forty freezer and thawed in a sink full of hot water. One at a time they were removed from the sink and analyzed. Ten cherries were weighed and then juiced. Some juice was removed and placed on the refractometer and ten millilitres of juice was measured out into a beaker. The pH was tested and then the juice was transferred into a petri dish and the colour was measured. Then the juice was placed in a container and frozen over night. This was done for all twenty nine samples. Then the next day the juice was removed from the freezer, thawed and the percent malic acid was measured using the Hanna Instruments H184432 Fruit Juice Titratable Acidity machine. Then pictures were taken comparing the fruit and juice of the canned cherries with the frozen fruit and juice.

Food Centre Analysis

The Saskatchewan Food Centre used similar methods as above for sugar and acidity measurements. Subjective analysis was based on a panel of 9 who were employees of the food centre and/or were food processors. (note: the Sask Food Processors Association is located in the same building, some members and/or employees volunteered their time).

The food centre developed methods based on their experience with other prairie fruits, some of which were proprietary methods for other crops. What will be in the results section is the final recipe developed.

Process for dried cherries

1. Weigh raw cherries, Spread cherries evenly on oiled metal mesh screens (use sunflower oil) of 1 to 2 cherries thick for drying
2. dry cherries at 75 °C in air oven
3. Monitor the Aw every 15-30 minutes depending on Aw after cherries are in the oven. Start monitoring after drying for 2.5 hours at 75°C. Do not allow berries to dry below 0.61 in the smoke house, need to monitor Aw closely. Stop drying when Aw=0.68, berries will continue to loose moisture upon cooling. Check Aw of cooled cherries, Record End product AW @end of drying
4. Optional step: need to confirm with client----Coat surface of cherries with spray gun filled with sunflower oil (usage: ~1% or less w/w basis). ***coating oil onto berries is to prevent berries sticking to each other, need to check with client if they want oil in the ingredient list.
5. Store cherries in a close container for 24 hours before packing, Monitor AW before packing, record final weight for %yield calculation.
6. Package cherries in bags (gas flushed and pack with O2 scavenger)

Sugar Infused method for dried cherries

Sugar infusion is a process where cherries are infused with sugar by immersing them in high Brix syrup before drying. This reduces drying time and sweetens dried cherry products. The finished product resembles a raisin or craisin. The sugar infusion drying process is also more economical than a typical drying process because it reduces drying time from about 14 hrs to 4hrs. To achieve the high brix necessary, cherries are submerged in syrup of about 60% brix for about 12 hrs until the cherries reach 45% brix. The cherries are then drained and dried at 50 to 75C, or until a target Aw(water activity) of 0.62. A panel of taste testers were then asked to give each of the cherries a rank of 1-5 for a number of criteria.

Procedure for Sugar Infused Dried Cherries

1. Weigh ingredients. Add cherry juice recovered from defrosting, syrup and sugar into kettle. Heat to dissolve sugar(<80°C).
2. Add hot syrup to cherries, let set over night.
 - Add weight on top layer of fruit in kettle to make sure fruit submerge in syrup for even infusion.

- Stir mixture to obtain sample to monitor cherry brix.
 - Stop infusion process when cherries reached 45 brix.
3. Separate cherries from juice using screens, low pressure water rinse surface of cherries to remove sugar on surface. Drained excess water. (don't immerse into water bath)
 4. Spread cherries evenly on metal mesh screens (oiled, use same oil as step 6) of 1 to 2 cherries thick for drying.
 5. Start drying at 75 °C for 2-3 hours and proceed to the next temperature (see below) in the smoke house

Drying cycles:

- 75 °C for 2-3 hours (pasteurization step)
 - 50 °C for 2 hours
 - Decrease temperature to slow down drying when cherries' AW near target values of 0.62
6. Monitor the Aw every 15-30 minutes depending on Aw when cherries' Aw near target value. Start monitoring after drying in Smoke house for 2.5 hours at 75°C. Stop drying when cherries reach AW 0.65 (cherries will continue to loose moisture upon cooling)
 - ***Do not allow berries to dry below 0.6 in the smoke house, need to monitor Aw closely.

Check Aw of cooled cherries, Record End product AW ***Coat surface of cherries with vegetable oil; usage 1%

7. Store cherries in a close container for 24 hours before packing, Monitor AW before packing.

Cherry Beef Jerky

Cherry flavoured beef jerky is a processing option that we explored with the Food Center. Three recipes were prepared. The first recipe used wet, sugar infused sour cherries. These were the cherries which were sugar infused, but not dried yet. The second recipe used the dried sugar infused cherries, and the third used thawed frozen cherries.

Alterations from the original plan

Because the season was wetter and cooler than most years the ripening season was stretched out to be 6 weeks instead of 4, thus much longer than anticipated. We chose to go with a once per week sampling date and include more advanced selections in the ripeness study. Excessive rain caused a disruption in field activities which significantly delayed the results of the project. Weeds were overwhelming in fall and needed to be attended to at a time when normally we would have had time to do much of this project. Frozen cherries from previous years were included in the study to better understand the impact of the 2010 growing season.

The Canadian Cherry Producers Association was unable to obtain 'Montmorency' cherries from Ontario or Michigan, although several attempts were made through different channels. It may have been that they did not want us to have them or that they are not prepared to send small orders. Where appropriate data about 'Montmorency' cherries is mentioned in the results section from various publications.

Vitamin C and Antioxidant analysis was not done directly. However, the juice colourimeter measurements are an indirect measure of anthocyanins which is a major type of antioxidant. It was felt to be more important to do an in depth colour analysis than to focus in this area. Colour analysis of ripening cherries consumed far more time and resources than originally planned, but it was thoroughly done. It required the purchase of an additional camera and computer as well as software. We also needed to learn to use the various new programs and use of the new camera.









































































The choice of which products to investigate was based on consultations with the Cherry Producers and the Food Centre and based on our budget. It did not make much sense to investigate similar products like jam, ice cream toppings, and pie filling which are adequately covered by most cookbooks. Instead it was deemed more valuable to study dried fruit, sugar-infused dried, jerky, canned and frozen fruit in more detail. In 2 cherry marketing studies, dried fruit was listed as the top product worth pursuing for the industry. The muffin and jerky mini studies both involved dried cherries as an ingredient.

Because the Food centre required larger amounts of cherries for some experiments, we used cherries of some varieties from previous years.

(d) Results

Ripeness Study: Named Varieties

The graphs and tables that follow highlight data most important to growers and processors of Saskatchewan Cherries. Particularly emphasized is the data on the 6 varieties already released by the U of SK. There are in fact 72 pages of data generated by the SAS program, which has standard errors and contains all the data on the unnamed advanced selections. This data is included in the appendix. The progression of colour is important for growers, so those images are shown.

	July 21/10			July 28/10			Aug 4/10		
	Cherries After Picking	Average Colour	Juice	Cherries After Picking	Average Colour	Juice	Cherries After Picking	Average Colour	Juice
Carmine									
Jewel									
Crimson									
Passion									
Cupid									
Juliet									
Romeo									
Valentine									























































	Aug 11/10			Aug 18/10			Aug 25/10		
	Cherries After Picking	Average Colour	Juice	Cherries After Picking	Average Colour	Juice	Cherries After Picking	Average Colour	Juice
Carmine Jewel									
Crimson Passion									
Cupid									
Juliet									
Romeo									
Valentine									

Figure 2. Colour changes in fruit and juice during the ripening season. Average colours are computer generated averages of skin colour of 4 reps.

Carmine Jewel						
Crimson Passion						
Cupid						
Juliet						
Romeo						
Valentine						

Figure 3. Average colours for all named cherries through the ripening season. This grid of colours will form the basis of colour cards for growers to compare to their ripening cherries

One of the ways to determine peak ripeness is by measuring the size of the cherries. When fruit size is at a maximum, growers would get the highest yields. However, after the peak the cherries begin to dehydrate. The result is that a dehydrating cherry increases in sugar content. A slightly dehydrated cherry is still marketable if wrinkles have not appeared. Thus, fruit size is a much better way to determine harvest than sugar content, even though sugar content is very important.

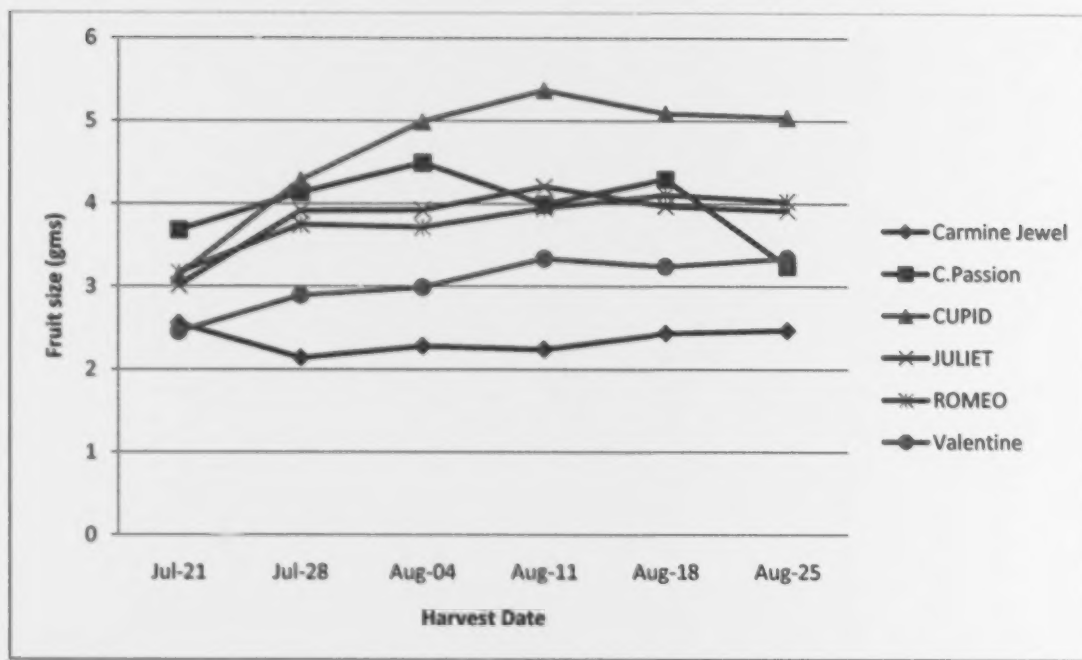


Figure 4. Fruit size changes through the growing season in 2010

The graphs comparing varieties that follow are based on data at the optimum harvest date based on size of fruit. (Note: In the graph above there is a suspiciously high reading for Carmine Jewel on the 1st day which was ignored in considering the optimum harvest date. The Carmine Jewel in the 'Advanced Selection field' was only 1.9 gms on the first day.)

Environmental factors and crop load should be considered when viewing the data below. Carmine Jewel, Juliet, and Valentine had minimal/no winter damage and were carrying a full crop load. Cupid had no winter damage but bloomed later than the other varieties during days of intense rain and consequently had very low fruit set. Romeo and Crimson Passion had severe winter damage during the winter of 2008/2008 and also had crop loads perhaps 25% of normal. The varieties with lighter crop loads may have had higher sugar content and larger fruit than normal.

Based on largest fruit size, there was only 1 early cherry variety (Juliet) and 2 advanced selections (7-19-28.7 and 7-32-10.7) that peaked on August 11. All other cherries peaked on August 18th.

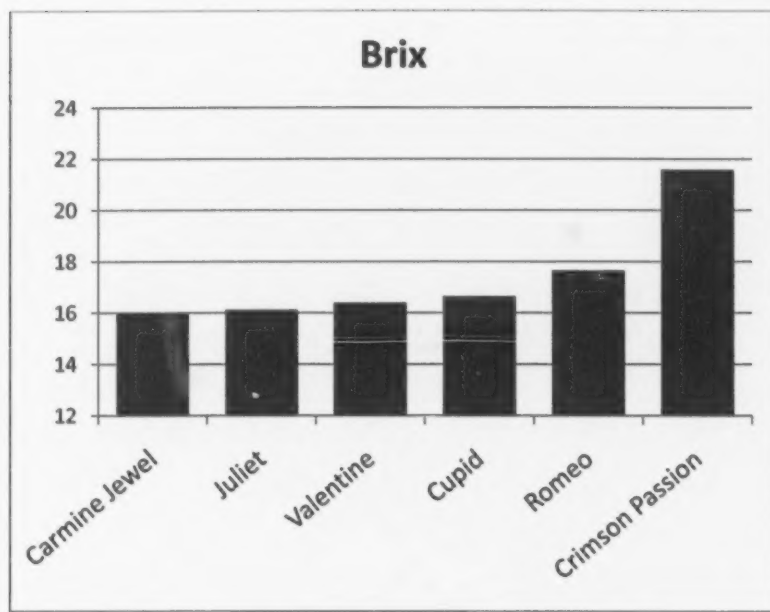


Figure 5. Sugar content (Brix) of Named Cherries at their peak ripeness.

We expected sugar content to be low this year as there was much rain, clouds and not which could lead to water imbibed cherries with less light for making sugars. But sugar content of even our lowest cherry, Carmine Jewel, was 2 Brix higher than reports from New York (Yoon et al., 2005) than the most popular American cherry variety 'Montmorency'. Romeo and Crimson Passion were clearly superior this year while the others had similar sugar content (Fig.5). But pH was within 0.1 for all varieties (Fig.6).

While pH is a relatively easy measurement to take, total acidity is much more important for processors (Fig. 7). 'Cupid' is in a class by itself with low acidity but is similar to Crimson Passion for having the highest sugar:acid ratio (Fig.8). These two varieties may have more potential as a fresh fruit or in products where sugar is not added. Processors of many products of cherries may prefer more acidity if they are adding sugar. 'Montmorency' is reported to have a sugar:acid ratio of 10.7 and so would be similar to four of our varieties.

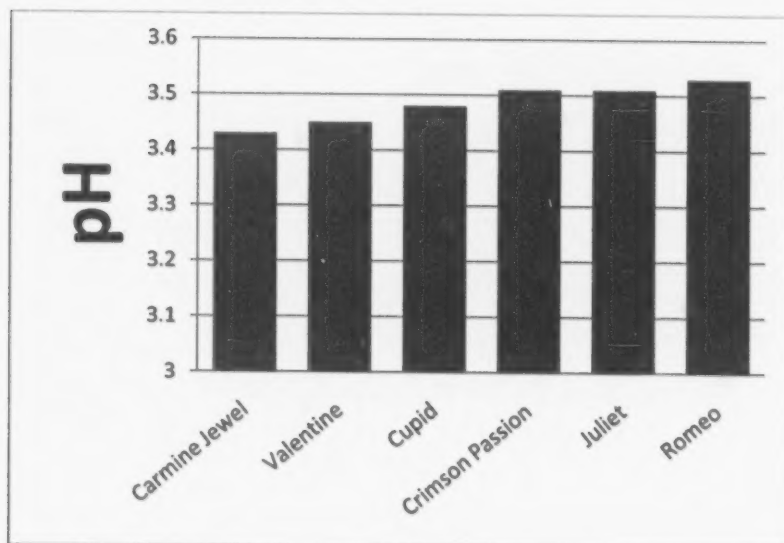


Figure 6. pH of cherry varieties at their peak ripeness.

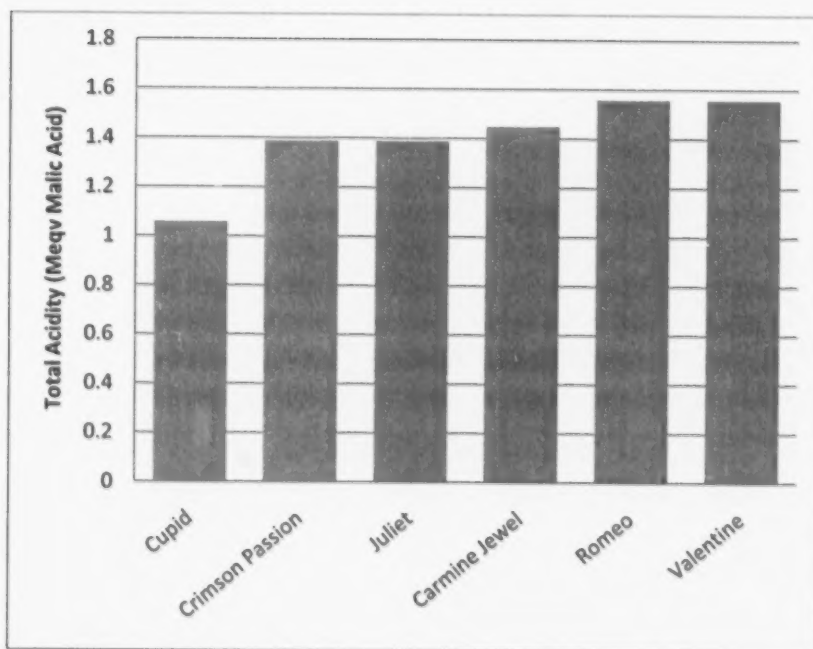


Figure 7. Total acidity of cherry varieties at their peak ripeness

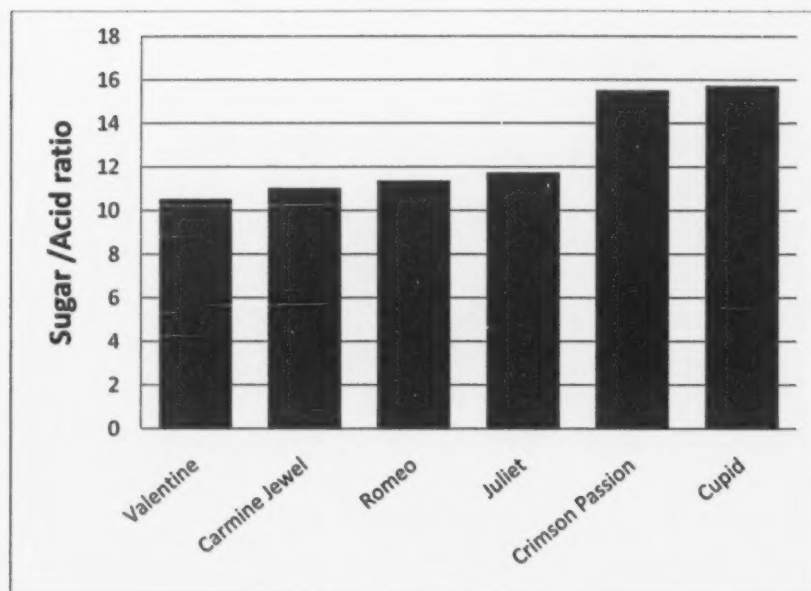


Figure 8. Sugar/acid ratios of cherry varieties at their peak ripeness.

Comparison of 2010 cherries to frozen cherries from 2008 and 2009

Curiosity about the impact of our unusual summer inspired us to search through our freezer to find samples of our cherries from previous years. Data presented in Figure 9 should be considered as indicative but not solid proof of year to year variation. In 2008 and 2009 years we harvested fruit from the original bushes when they 'seemed to be good enough'. This study in 2010 was more planned and data is presented from the peak time of harvesting.

Despite the different types of growing seasons there are many similarities that hold up in the figure 9 graphs. But it does seem to indicate that Crimson Passion was unusually high in sugar content this year. Crimson Passion and Romeo have consistently high sugar contents, while Valentine and Carmine Jewel are generally the lowest.

The sugar to acid ratio is a better indication of suitability for fresh eating than sugar content alone. A fruit with medium sugar but high acid will be perceived as sour, while a fruit with medium sugar but low acid will be perceived as sweet. **Error! Reference source not found.** shows the ratio between sugar and acid of the cherry cultivars in multiple years. Scoring high on this graph is Cupid and Crimson Passion. When comparing multiple years it is clear that our cherries are of similar quality to Hungarian Cherries (Papp et al., 2009) and superior to Montmorency cherries(Yoon et al., 2006)

Color intensity could be a consideration when deciding which cultivars to use for processing applications. Often the cultivars with deeper colours can be added to products at lower dilutions while still delivering perceived richness. **Error! Reference source not found.** illustrates Carmine Jewel's consistently high colour intensity. Colour intensity is often linked to antioxidant levels. Colour producing pigments, anthocyanins, are often highly antioxidant. The health benefits of those cherries with the deepest, darkest colour could be a strong selling feature for growers.

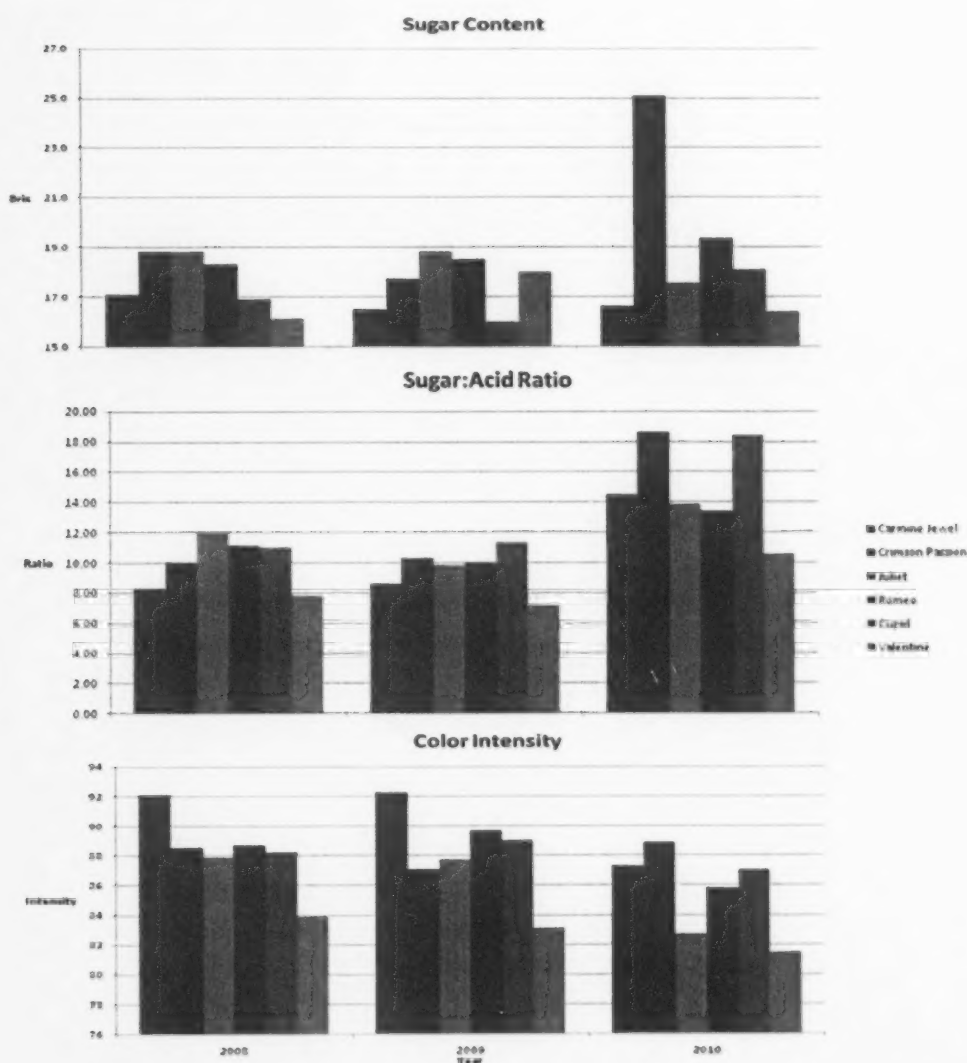


Figure 9. Comparison of sugar, sugar:acid ratio and colour intensity of stored sour cherries with the current seasons fruit.

Colour changes in the advanced selections are indicated in Figure 10. 13rd of the advanced selections are light coloured while the others are black. If any of these selections are released in the future, these colour charts and the other data gleaned in this study could be used to create harvest like those in figure 11. Advanced selections had only 5 harvest dates as we need time to harvest all the cherries and did not have the resources to pick, sort and pit all cherries at once.

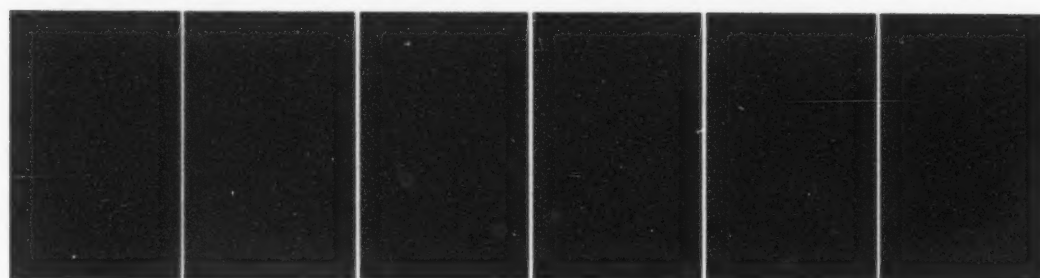
	July 21/10				July 28/10				Aug 4/10				Aug 11/10				Aug 18/10			
	Cherries After Picking	Average Colour	Juice	Data	Cherries After Picking	Average Colour	Juice	Data	Cherries After Picking	Average Colour	Juice	Data	Cherries After Picking	Average Colour	Juice	Data	Cherries After Picking	Average Colour	Juice	Data
7-9-845																				
7-6-161																				
7-6-2945																				
7-17-124																				
7-17-312																				
7-19-287																				
7-21-223																				
7-27-275																				
7-29-322																				
7-30-107																				
Carmine Jewel																				

Figure 10. Sugar and Juice colour changes of advanced selections in 2010.

The 6 harvest cards developed from this study are depicted below. Also included on the cards is the dates, average fruit size and sugar content and a note describing the type of season that occurred when these cards were created. The information will help growers recognize the associated changes that occurred throughout the growing season and may help them to predict the benefits or lack of benefits by waiting and extra week or 2 to harvest.

The gray bar on the bottom of the card is 50% gray and may be useful when reproducing the card. The back of the card could contain the draft cherry standards presented at the end of this document, but that would need to be agreed upon by the growers. It could also contain more information about the variety or CCPI.

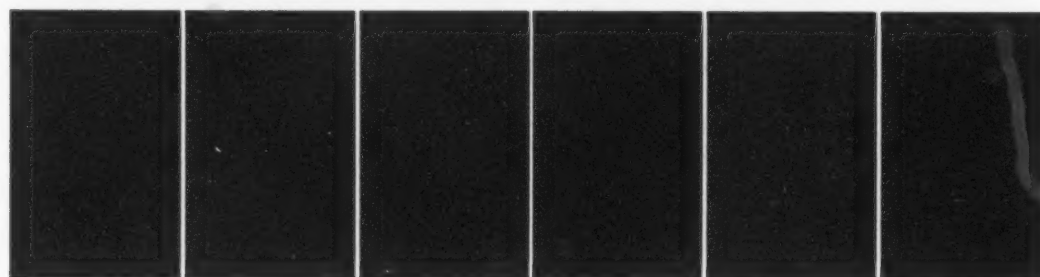
Figure 11. Harvest Colour Cards developed from the ripening study.



-----Optimum Colour Range-----

July 21	July 28	August 4	August 11	August 18	August 25
13° Brix	15° Brix	16.3° Brix	16.5° Brix	16.5° Brix	17° Brix
1.9g Average Berry Weight	2.1g Average Berry Weight	2.3g Average Berry Weight	2.3g Average Berry Weight	2.6g Average Berry Weight	2.4g Average Berry Weight

Carmine Jewel

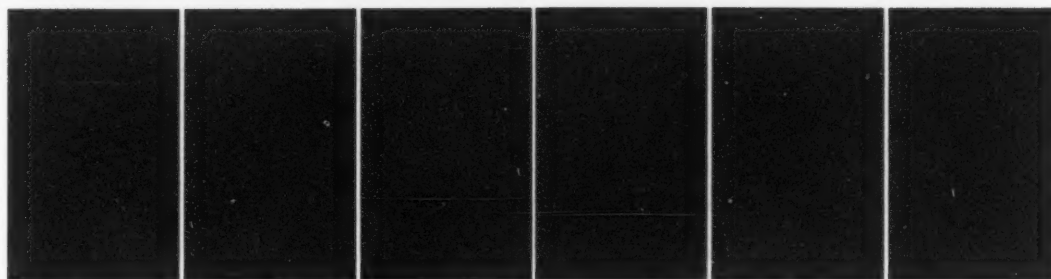


-----Optimum Colour Range-----

July 21	July 28	August 4	August 11	August 18	August 25
16.9° Brix	18.6° Brix	19.8° Brix	21.6° Brix	21.6° Brix	25.0° Brix
3.7g Average Berry Weight	4.1g Average Berry Weight	4.5g Average Berry Weight	4.0g Average Berry Weight	4.3g Average Berry Weight	3.3g Average Berry Weight

Crimson Passion

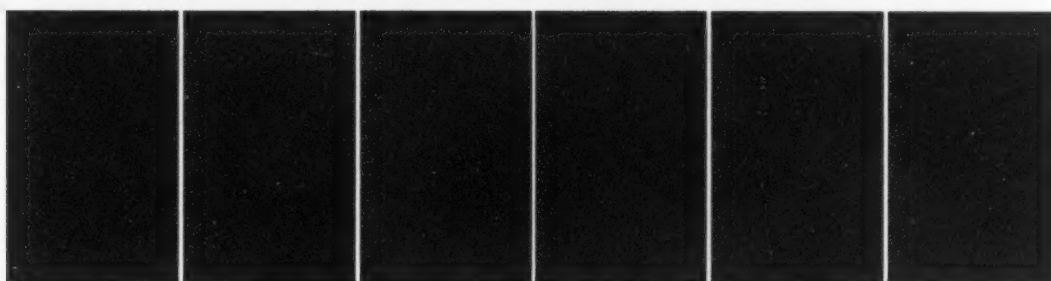




-----Optimum Colour Range-----

July 21	July 28	August 4	August 11	August 18	August 25
12.1° Brix	14.3° Brix	14.7° Brix	15.1° Brix	16.6° Brix	18.1° Brix
3.1g Average Berry Weight	4.2g Average Berry Weight	4.9g Average Berry Weight	5.3g Average Berry Weight	5.1g Average Berry Weight	5.0g Average Berry Weight

Cupid

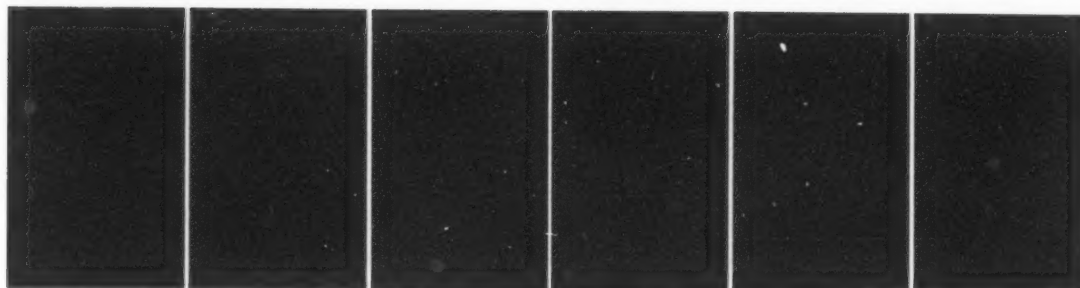


-----Optimum Colour Range-----

July 21	July 28	August 4	August 11	August 18	August 25
13.3° Brix	14.1° Brix	14.7° Brix	15.5° Brix	15.3° Brix	15.6° Brix
2.8g Average Berry Weight	3.3g Average Berry Weight	4.9g Average Berry Weight	3.1g Average Berry Weight	3.2g Average Berry Weight	3.2g Average Berry Weight

Juliet

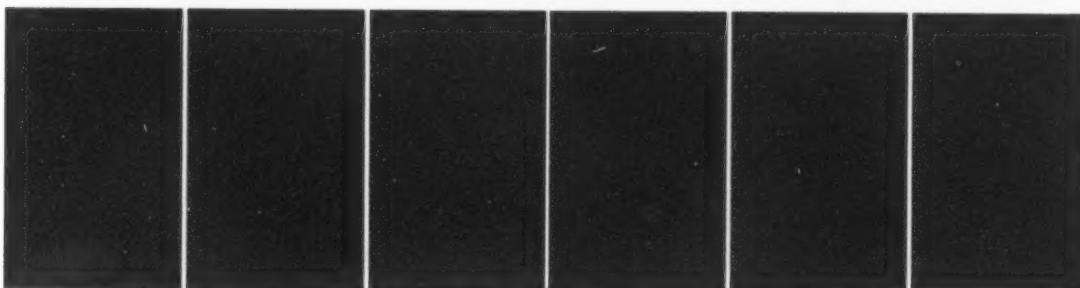




-----Optimum Colour Range-----

July 21	July 28	August 4	August 11	August 18	August 25
15.4° Brix	16.0° Brix	18.3° Brix	18.0° Brix	17.7° Brix	19.4° Brix
3.2g Average Berry Weight	3.7g Average Berry Weight	3.7g Average Berry Weight	4.0g Average Berry Weight	4.1g Average Berry Weight	4.0g Average Berry Weight

Romeo



-----Optimum Colour Range-----

July 21	July 28	August 4	August 11	August 18	August 25
13.9° Brix	14.6° Brix	15.3° Brix	15.2° Brix	15.3° Brix	16.4° Brix
2.5g Average Berry Weight	2.9g Average Berry Weight	3.0g Average Berry Weight	3.3g Average Berry Weight	3.2g Average Berry Weight	3.3g Average Berry Weight

Valentine



Considering the harvest cards presented above there appears to be a 3 week harvest window for all the named cherries in 2010. When the cherries were at their largest the colour on the week before and after as well as sugar content was very similar.

Breeder Index for fruit quality based on the ripeness study

With so many attributes studied it is difficult to decide which of the advanced selections may be superior to existing varieties. Table 2 simplifies the data into a breeder index. Carmine Jewel is used as a benchmark and for comparison because it was our first released variety and it is the most widely planted of all our cultivars. Based on fruit quality alone the chart below indicates that 7-32-10.7 and 7-29-32.2 warrant further investigation. Further investigation would include yield trials and suitability for mechanical harvesting.

Table 2. Simplification of fruit quality traits measured in the ripeness study. Numerical data was transformed to a 5 point system with 5 being the best.

Cultivar	Brix	Sugar:Acid Ratio	Peak Berry Weight	Fruit Pit Ratio	Colour Intensity	Total
Crimson Passion	5	5	4	4	5	23
Cupid	3	5	5	3	4	20
7-32-10.7	3	4	3	3	5	18
7-29-32.2	3	4	3	3	4	17
Carmine Jewel	3	3	1	5	5	17
Juliet	3	3	3	4	3	16
Romeo	3	3	3	3	4	16
7-6-16.1	3	2	2	3	5	15
7-6-23.45	4	2	2	3	3	14
Valentine	3	3	2	2	3	13
7-17-12.4	2	3	1	3	3	12
7-3-8.45	3	2	2	2	3	12
7-27-27.5	2	3	2	2	2	11
7-17-31.2	2	2	2	3	1	10
7-19-28.7	2	3	2	1	2	10

Preliminary Food Centre Evaluations

Frozen cherries of various varieties were given to the Food Centre to familiarize them with the range quality they could expect during the study. The food centre preferred Romeo and then Juliet for highest flavour as their first impression.

Table 3. Preliminary taste test of U of Sask Cherries at the Food Centre.

SOUR CHERRY VARIETY	BRIX	PH	OBSERVATIONS	size (diameter, mm)					Avg.
Romeo	18	3.42	sweet, lots of flavors, close to grocery cherry, v. dark red	22.5	20	21	18.8		20.6
Evans	16	3.27	tart, unripe taste, good flavors, chewy skin, close to grocery cherry, v. dark red	22.3	21.6	20	23.1		21.8
Valentine	18	3.23	v.sour/ tart, bright red in color, soft skin, lots of juice from thawing process, lots of cherry flavor, not pitted	23.9	21.7	17	20.1		20.7
Juliet 2008	18.3	3.27	big cherries, lots of juice, good taste, tart and sweet, flavorful, close to grocery cherry taste, darker than valentine, good for dry infuse. Bigger cherries compared to carmine	20.2	22.3	24	22.1		22.3
Carmine Jewel 2008	14.8	3.05	v. sour, lots of juice, v. small cherries, thinner skin, good for juice making, similar to Juliet, v. dark red	19	18.1	20	20.1		19.3

Later, larger quantities of fruit were given to the food centre for additional experiments and evaluations. The food centre analysis of Brix differed from the fruit program because they were using fruit from previous years and they were measuring the juice that was naturally released when frozen fruit was thawed. The fruit program used only 2010 cherries and crushed the fruit. Initial observations (Table 4) were categorized into a list of possible uses (Table 5) based on the Food Centres experience with other crops.

Table 4. Notes on cherry varieties and advanced selections, based on frozen fruit that had been thawed that were destined for drying experiments. Notes at the bottom were predictions of what may be found after drying.

SOUR CHERRY VARIETY	BRIX	PH	OBSERVATIONS
Valentine	18	3.23	v.sour/ tart, bright red in color, soft skin, lots of juice from thawing process, lots of cherry flavor
Cupid	20	3.39	tough skin, dark red in color, taste like fermented grapes, cheap cherry, over-ripe not fresh, able to hold juice
Juliet	20	3.37	big cherries, lots of juice, good taste, tart and sweet, flavorful, close to grocery cherry taste, darker than valentine, good for dry infuse. Big cherries compared to carmine
Romeo	20	3.56	skin is thicker than juliet, very good taste, tart, not a lot of juice loss
Carmine Jewel	13	3.16	v. sour, lots of juice, v. small cherries, thinner skin, good for juice making, similar to Juliet
7-29-32.2	15	3.37	taste close to cupid, less sour, less sugar, some juice loss, slightly sweet and tart, has aftertaste from skin, taste like unripe grape
7-17-31.2	16	3.24	very small cherries, sour, thin skin, very tart, lots of juice, the most sour one out of the whole list
7-32-10.7	15	3.41	very dark red, medium sized cherries, medium sourness, close taste to Romeo, thick skin, sweet and tart.
7-17-12.4	17	3.33	less sweet, very small cherries, sweet and tart taste, some juice loss
7-27-27.5	14	3.38	sour and sweet taste, tough skin, good taste, better skin texture and color, close taste to 7-29-32.2
7-19-28.7	15	3.37	very sour, lighter red, similar to grocery cherry, medium size
7-21-22.3	14	3.36	very sour/ tart, lots of juice, bad taste, medium size

Conclusion:

Valentine---is good for dried cherries

Romeo---is good for infuse cherries

Juliet---is second choice for infuse dried cherries

Carmine Jewel---multiple purpose, can be used to make all of above products

Based on these analyses, and on processing trials done at the Food Center, recommendations for processing techniques can be made. The following table describes the processing types, and the cultivars most suited for each.

Table 5. Categorization of cherry varieties based on observation of thawed frozen fruit.

Processing Option	Desirable Traits	Recommended Cultivars		
Canned, Maraschino, IQF	Cherries should be firm, maintain their weight after draining and resist becoming mushy	Crimson Passion: The firmest of all cherries tested, this cultivar will hold up best for this type of processing.	Romeo: Also a relatively firm cherry with a high drained, and dried mass	Cupid: This cultivar tested surprising well in this category. It maintained a good drained mass and could be a viable option
Dried Cherries	High Sugar Content	Crimson Passion: By far the highest sugar content in 2010. Also maintains a good dried mass for high dried cherry yields.	7-6-23.45: This cultivar tested above 18 brix. Progress of this variety will be monitored for possible release	Juliet: The 2010 season did not reflect well on this cultivar. Despite its poor performance this year, it is generally amongst the sweetest of the varieties.
Sugar Infused Cherries	Good Flavour	Romeo: Tested the best for flavour in a Food Center taste panel.	Carmine Jewel: Has an intense flavour which balances the sweetness of these products	Valentine: Gives a more interesting lighter red colour to the product
Wines	Intense Colour, low firmness, good juice yield	Carmine Jewel: Has the most intense colour of all the cultivars and has a good juice yield.	7-32-10.7: Second only to Carmine Jewel in colour, and provides the best juice yield of all cultivars tested. Progress of this variety will be monitored for possible release	
Cherry Jerky	A cherry with an intense colour and flavour will go a long way in a jerky	Carmine Jewel: Intense colour and flavour.	Romeo: Intense colour and flavor	

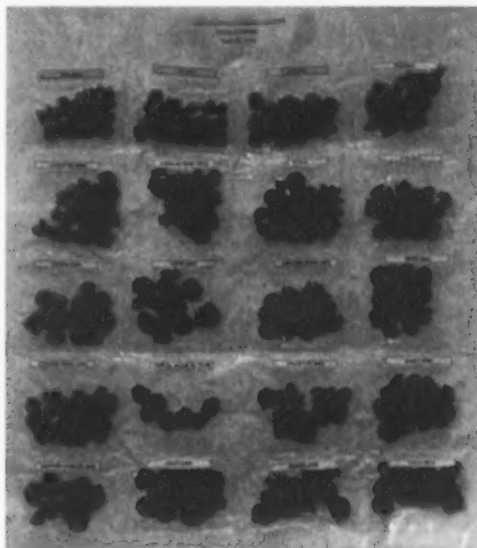
Table 6. Processing data on drying U of SK cherries. Most of these cherries were dried using only cherries with no sugar added but some of the named ones were further used in sugar infusion experiments.

<i>Sour Cherry</i>	Cherry Drained Weight	Rinsed Weight	Juice wght	Brix	PH	Final Aw	Final Dried Wt	% yield Base on drained cherry weight	Net drying time in air oven @ 75 °C
ID	(g)	(g)	(g)				(g)	%	(HR)
Cupid 2008	481.5	480.0	73.3	16.4	3.4	0.57	97.4	20.2	14.0
CJ 2008	501.5	490.1	60.7	18.2	3.3	0.57	106.6	21.3	14.0
Romeo 2008	466.1	463.3	65.9	18.6	3.5	0.53	90.1	19.3	14.5
Crimson Passion, 2008	140.0	136.6	10.8	18.0	3.3	0.56	25.2	18.0	14.0
Juliet 2008	518.4	511.2	87.0	18.0	3.3	0.50	89.5	17.3	14.5
Juliet 2009	521.8	510.1	85.3	18.2	3.3	0.51	93.7	18.0	14.0
CJ 2009	465.1	453.1	78.7	16.0	3.3	0.51	79.6	17.1	14.0
Romeo 2009	537.6	524.7	109.0	18.0	3.4	0.55	106.2	19.8	14.0
Valentine 2009	572.9	551.4	139.7	16.0	3.2	0.56	87.1	15.2	14.0
Cupid 2009	569.4	554.9	117.5	16.2	3.4	0.57	101.7	17.9	14.0
Crimson Passion 2009	61.7	60.0	4.1	17.9	3.3	0.56	13.5	21.9	14.5
Carmine Jewel 2010	551.3	540.3	107.9	17.6	3.4	0.53	107.9	19.6	14.0
Juliet 2010	521.3	506.9	84.9	19.0	3.4	0.52	97.0	18.6	14.5
Valentine 2010	462.7	451.6	87.9	17.8	3.3	0.53	83.4	18.0	14.0
7-29-32-2	528.1	513.2	90.2	15.2	3.4	0.57	82.7	15.7	14.0
7-32-10-7	425.2	411.9	105.2	12.0	3.5	0.55	62.9	14.8	14.0
7-19-28-7	470.6	453.6	104.9	13.4	3.3	0.60	73.2	15.6	14.0
7-17-12-4	462.7	444.3	103.1	16.0	3.3	0.50	72.0	15.6	14.0
7-21-22-3	424.0	393.0	109.7	13.4	3.3	0.57	60.2	14.2	14.0
7-27-27-5	551.3	515.0	128.8	15.0	3.4	0.59	80.3	14.6	14.0
							Avg.	17.6	14.1

Information in table contains information helpful for processors of traditional dried cherries (not sugar infused). Juice coming off the thawed cherries is an obvious by-product that should be used for other products. The table above can be used to predict how much juice will come off when thawed as well as the sugar content of the juice. Also one can predict on average, the dried product will be around 17.6% of the original weight. Due to the heat requirements, drying fruit is an energy intensive processing option. A processor who is going to dry their cherries should pay close attention to the sugar content. It takes less time, less energy, and therefore costs less, to dry a 25% brix cherry than one with 18% brix.

From these dried cherries, two displays were created for both the U of SK Fruit program and the Canadian Cherry Producers Inc. They were already used at the Crop Production Show.

Figure 12. Dried cherry display created for trade shows.



The cherries dried the traditional way were not evaluated for quality once they were dried. They will be likely be used in an upcoming workshop of the CPPI. For this study it was most important to obtain the information on what to expect when drying the cherries and developing a protocol. The small quantities of less than 100gms of fruit would not allow extensive evaluations.

But larger quantities were available for evaluating 4 of our named varieties after being sugar-infused and dried (Table 7). Several kgs were produced that were used in making beef jerky and muffins, but will also be used in future workshops or trade shows.

Table 7. Taste panel ratings and comments on sugar-infused dried cherries. Based on 9 panelists from the food centre and additional volunteers from the SK food processing association. Some comments may be conflicting as compiled from several panellists.

Legend: 6=like very much 5= like moderately 4=like slightly 3=dislike slightly 2=dislike moderately 1=dislike very much

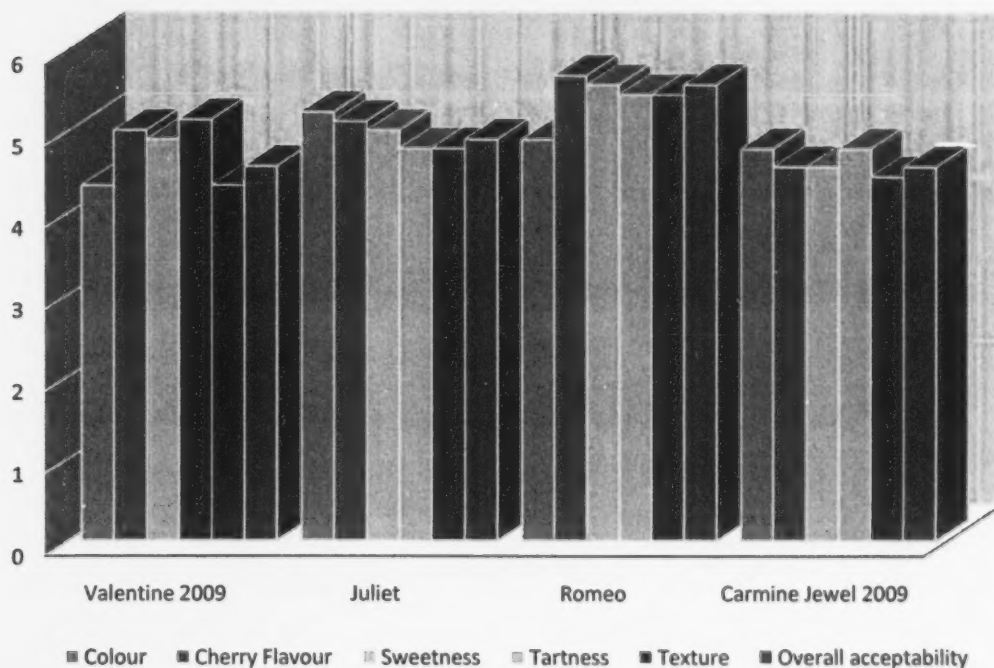
	431 Valentine 2009 PH=3.20 AW=0.417	258 Juliet PH=3.23 AW=0.405	200 Romeo PH=3.29 AW=0.473	787 Carmine Jewel 2009 PH=3.27 AW=0.455
Colour	4.33	5.22	4.89	4.78
Cherry Flavour	5	5.11	5.67	4.56
Sweetness	4.89	5	5.56	4.56
Tartness	5.13	4.78	5.44	4.78
Texture	4.33	4.78	5.44	4.44
Overall acceptability	4.56	4.89	5.56	4.56
Comments:				
Colour	<i>red started to have some brownish tinges; not sure if I like dark or light; nice reddish colour; the best colour-wise; very red but somewhat pale</i>	<i>very bright, shiny; not as dark as I would like but very good glaze; nice red colour; good; brilliant red is very acceptable</i>	<i>bit darker than #431(Valentine 2009) and #258 (Juliet); good; too dark, could be a little redder; looks like raisin; gloss was nice; a little dark</i>	<i>colour dark; little too dark, still too dark; dark...interesting; nice dark red; good colour; nice dark colour</i>
Cherry Flavour	<i>not much cherry flavor; consistent flavor with no changing aftertaste; cherry flavor not very strong; good - very good; not much cherry flavor left; good</i>	<i>very good; develops off aftertaste; nice; good</i>	<i>flavour and sweetness well balanced; good; strong flavor; initial flavor not ideal but flavours developed; good</i>	<i>less flavourful; good; not a strong flavour; lack flavour-bland; lacking in flavour; good</i>
Sweetness	<i>sweet but not overly; excellent level</i>	<i>mildly sweet; very mild sweetness, not quite enough; not too sweet</i>	<i>just right, sweetness and tartness nice balance; slightly too sweet; flavour very nice; a little too sweet</i>	<i>low sweetness is good; good; just a little too sweet; a little too sweet</i>

Tartness	<i>enough to add to flavor profile but still mild; raisin tartness; a little tart; moderate sweetness is good; tartness very low for cherry; lacking tartness</i>	<i>excellent; slightly too tart; more tart than sweet; tartness is low</i>	<i>good for a cherry product; very good; not overpowering but still noticeable; lacking somewhat</i>	<i>low tartness; too tart; nice level of tartness</i>
Texture	<i>chewy; slightly too firm; softer than 787 (Carmine Jewel 2009); too chewy, have to work hard to eat it; fruits very hard to chew/ dry; slightly chewy</i>	<i>smooth, not too chewy; slightly hard but nice chewiness; perfect; a little dry and hard; good</i>	<i>very good, don't have to chew too much; too soft; it was firm but not too hard; a bit mushy; good mouthfeel</i>	<i>not too dry but less juicy mouthfeel; very very chewy; very dry tasting; too dry; just a little too firm; good texture; good - not too tough</i>
Overall acceptability	<i>flavor profile was nice but some observational properties were lacking; more like raisins</i>	<i>combined flavor was okay but nothing stood out; nice flavour; chewy; hard to chew/ dry</i>	<i>overall the best product #1; this is "BEST" #1, excellent; like very much except for the color; good flavour, texture too soft</i>	<i>can rank as #2 of all; least liked - #4; look and taste acceptable</i>
Overall comment	<i>color and texture is off, tartness is very good; could be better if cherry flavor was more evident; rate #3; weaker flavor and lacking tartness, somewhat chewy</i>	<i>good flavour and sweetness, very acceptable; sample is shiny in appearance, good colour, flavour and texture, best overall; almost a bit of an aftertaste; not bad rate #2; feel more like cherry, better than #431 (Valentine 2009)</i>	<i>very good; very good flavour and colour, favorite flavour; a little too sweet and lacking tartness</i>	<i>overall - not very good; very good colour, good texture, flavour not quite what I would like; excellent but very sweet</i>

The chart above was also summarized in graph form in figure 13.

Figure 13

Analysis of Sugar-Infused dried cherries on a six point scale by 9 panelists.



After the food centre completed their evaluations of dried cherries, they invited 3 members of the U of SK fruit Program and 2 members of the Canadian Cherry Producers Inc. to compare 'normal dried' and 'sugar-infused' cherries of Carmine Jewel, Valentine, Romeo and Juliet. It was unanimously agreed that the sugar infused cherries were superior in flavour and texture than regular dried cherries.

When comparing amongst sugar infused cherries, it was felt that Romeo and Juliet were very similar and had slightly better flavour than Carmine Jewel. Although Valentine was the least favourite it seemed acceptable. It took some time for us to decide which was best and gave us pause to wonder if we had only tasted Valentine, would we think it was very good?

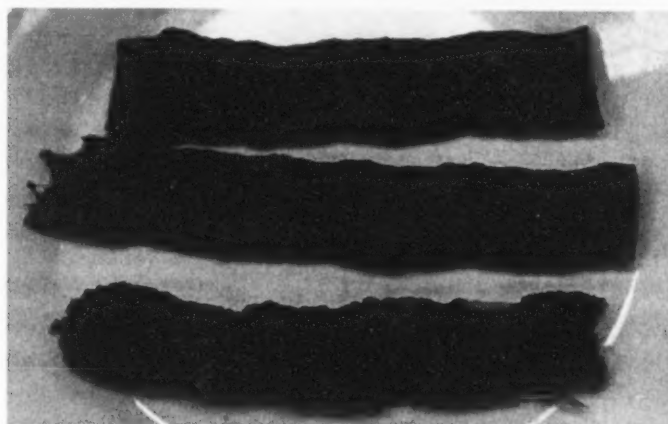
Figure 14. Dried cherry tasting at the food centre.



Cherry Beef Jerky

Potentially any cultivar could be effective for use in a sour cherry jerky. The cherries are present in such a small percentage and are not a dominant flavour so all cultivars will have similar effects on the finished product. It may be said that an intense coloured and flavoured cultivar may be able to be used in smaller volumes while delivering the same flavour.

Figure 15. Beef jerky made with sweetened or non-sweetened dried cherries (top 2) had good quality but jerky made with frozen cherries (below) had poor texture and easily fell apart.



The three cherry jerky recipes developed are outlined in Table 8. A panel of taste testers agreed that jerky made from sugar infused dried cherries resulted in the best product but that unsweetened cherries were also very good..

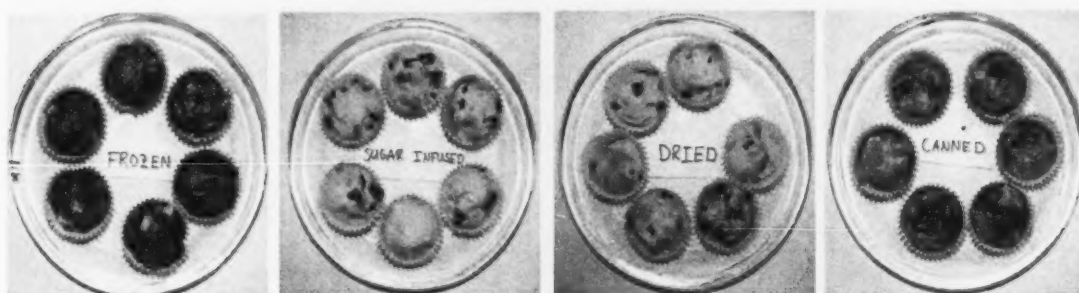
Table 8. Cherry Jerky receipes and comments on type of cherries to use.

	test 1	test 2	test 3
	Wet infused cherry (CJ, 2009)	Dried infused cherries (CJ, 2009)	Frozen cherries (CJ, 2009)
Ingredients	%	%	%
Beef Trim (lean beef)	76.43	81.43	71.43
Salt	1.80	1.80	1.80
Sodium Erythorbate	0.050	0.050	0.050
Prague Powder (6.4%)	0.300	0.300	0.300
Dextrose	3.900	3.900	3.900
Golden Yellow Sugar	2.000	2.000	2.000
Sod Tripoly Phos	0.280	0.280	0.280
Black Pepper 32M	0.100	0.100	0.100
Garlic Powder	0.140	0.140	0.140
Cherries	15.000	10.000	20.000
	100.000	100.000	100.000
Batch weight (Kg):	0.895	0.819	0.904
meat matrix PH (raw):	5.52	5.89	5.14
End weight (Kg):	0.485	0.504	0.403
% yield:	48.48	61.59	44.57
Product final Aw:	0.856	0.851	0.901
Net drying time in smoke oven (Hour):	2.5	2.5	2.5
comments:	good cherry flavour, dark red cherry color in meat	good cherry flavour, best one out of 3, lighter color than test 1	nice tart flavour, too tart, meat texture is not acceptable

Muffins with dried, canned or frozen cherries

Frozen cherries tasted the best in muffins, were moist but were blue/purple. Dried and Sugar Infused cherries were next best for flavour and looked 'normal' . Canned cherries had much less flavour in muffins, probably much flavour was left in the juice.

Figure 16. Muffins made with frozen, sugar-infused dried, normal dries or canned cherries. Frozen cherries tasted the best but both dried cherries had more acceptable colour.



(e) Conclusions and Recommendations

Use of Colour Cards

This study has documented the changing flesh and juice colours of the Saskatchewan cherry cultivars. Use of these cards will allow growers to better understand what their fruit should look like when at their peak. It should be noted that it will be important to obtain a printer who can exactly reproduce the colours seen on the screen into print format.

Data from this project can provide cherry processors with valuable information on general procedures with some idea of how similar or different the various varieties will be. Dried cherries have been suggested as a valuable market to consider with these cherries and Juice markets have been greatly expanding in recent years. This project delivers much information in these areas.

Cherry Grading Standards

As the cherry industry using Saskatchewan Cherries comes into production it could become important to create quality standards, especially if the industry wishes to market their cherries as a gourmet alternative to the lower quality 'Montmorency' cherries. It may be best to establish a quality standard that sets 'Class B' as something similar to 'Montmorency' and 'Class A' and above as clearly out of reach of the typical 'Montmorency'. Montmorency is typically around 12 Brix so perhaps 14 brix would be a good place to start.

Perhaps a 'Class AA' could be allotted to cherries within the Saskatchewan Cherries that are more superior.

Growers will have to decide if they want fruit size to be a part of the grading standard. Carmine Jewel is the smallest of the cherries and was unusually small this year. Size

matters for apple grading, but is not considered valuable for Saskatoon standards. Instead Saskatoon growers chose to emphasize uniformity of fruit. As a primarily processed crop, size shouldn't be too important except that cherries that were too small in 2010 (likely due to the poor summer conditions) were having difficulties in pitting machines. In previous years Carmine Jewel was in the 3.25 to 4gm range, therefore I suggest setting the standard for fruit size to 3gms for grade A.

Perhaps an 'AAA' grade could be created in the future based on which varieties are deemed to have clearly higher quality than others.

It is highly recommended that cherry growers take a few years to investigate the quality of their own cherries using the colour cards created in this project. By picking at the correct time they can determine what the acceptable standards for their cherries are. It does no good to have a standard set so high that no one can attain it, but certainly a grade 'A' cherry should be something that processors and consumers will recognize as being of good quality and 'AA' should be exceptional. It should be pointed out that that sorting equipment could be used to separate higher quality fruit from a crop that is not uniform. However, the U of SK cherries ripen evenly and are of generally high quality if properly cared for and harvested at the right time.

Table 9. Draft Standards for Saskatchewan Cherries.

Grade	Colour	Brix	Fruit Weight	Appearance
AA	95% of the fruits have colour in the optimum range for that variety	≥17Brix	≥4.0 gms. Avg. 80% of the fruit are within 0.5gms. of the avg.	Less than 0.01% dehydrated, cracked or blemished
A	80% of the fruits have colour in the optimum range for that variety	≥14 Brix	≥3.0gms Avg. 80% of the fruit are within 0.5gms.of the avg.	Less than 1% dehydrated, cracked or blemished
B	80% of the fruits have colour within 1 week of the optimum range for that variety	≥12 Brix	≥2.5gms Avg., no standard for weight variation	Less than 5% dehydrated, cracked or blemished
C	Fruit does not meet one of the categories in the upper grades but is still safe to eat and may have value in processing or fruit is of mixed varieties			
‘Peak Colour’ determined by 2010 study				
‘Brix’ determined by crushing 1 litre of randomly selected cherries				
‘Fruit weight’ determined by weighing 1 litre of cherries ÷the number of cherries				

(f) Acknowledgements

The dried cherries from the project were on display at the Saskatchewan Fruit Growers Association Booth at the Crop Production Show, Jan 2011.

Dr. Bors presented data from this project at the Saskatchewan Fruit Growers Association Annual Meeting in Jan 2011.

A poster was created summarizing this project which was on display at the 1st Saskatchewan Food Summit in Feb 2011.

This same poster is currently on display at the U of SK Ag Building on the 2nd floor. A copy of the poster is being made for the CCPI to be used in trade shows.

The Grower Harvest Cards carry the Sask. Ag. logo and have an acknowledgement to ADF. These will be likely be used by every commercial grower of U of SK cherries.

Whenever the Cherry Manual is revised for a second edition, material from this project will be included.

CCPI and The U of SK Fruit Program will be hosting a workshop to review the results of this project.

If any of the advanced selections studied in this project are released in the future, we will already have the data and colour charts needed to generate harvest cards for them; Sask Ag and ADF will be acknowledged on them.

This report will be used to generate several grower documents for the CCPI and The U of SK Fruit Program websites.

Material from the project will be incorporated into several of Dr. Bors courses at the U of SK as well as Extension lectures.

(g) Literature Cited

R.H. Bors and L. Matthews, 2004. Dwarf Sour Cherries: A Guide for Commercial Production. University Extension Press. 88 pages.

D. Konopacka, K. Jesionkowska, R. Klewicki and C. Bonazzi. 2009. The effect of different osmotic agents on the sensory perception of osmo-treated dried fruit. *Journal of Horticultural Science & Biotechnology* ISAFRUIT Special Issue 80-84.

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Kyung Young Yoon, Edward E. Woodams, Yong D. Hang. 2006. Relationship of acid phosphatase activity and Brix/acid ratio in cherries. *Swiss Society of Food Science and Technology. LWT* 39 : 316–320.

(h) Appendices

Two appendices will accompany this report as separate files:

1. PDF of the poster created for this project

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Please note that the title has been slightly altered to sound better.

University of Saskatchewan Cherries

variety differences and uses (ADF#20090405)

University of Saskatchewan Fruit Program, www.fruit.usask.ca

Principle Investigator: Bob Bors, Technicians: Ellen Sawchuk, Pete Reimer, & Rick Sawatzky

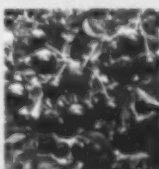
Saskatchewan Food Industry Development Centre Inc.: www.foodcentre.sk.ca Sara Lui, Brev Chesky, & Nai-ye Jay

Canadian Cherry Producers Association: <http://www.cherryproducers.ca> Grant Administrator: Bruce Hill



North Americans are familiar with bright red, very tart, sour cherries with low sugar content.

European sour cherries are dark & flavourful with high sugar content. The U of SK used European sour cherries in breeding.



Unaware that most U of SK cherries are dark, some growers and gardeners pick them weeks before they are ripe

The 8 U of SK cherries are different! They don't ripen at the same time and they aren't the same colour when fully ripe. By understanding the differences between them, growers can harvest them at optimum quality. If harvested at the right time, Saskatchewan sour cherries are so flavourful that it's misleading to call them 'Sour'. Information learned in this study will be of value to companies that use cherries in their products.

Ripeness Study

- 6 named varieties and 10 advanced selections picked weekly
- 4 samples x 6 weeks x 16 selections = 384 samples for analysis
- Tests done: colour analysis for skin and juice, sugar content (Brix), weight, total acidity, pH and colour



Special Colour Chart included in Photograph

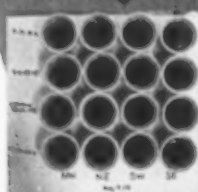


Computer programs used to create average colour for each day

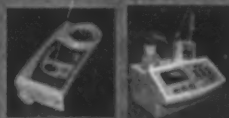
Average colours go on harvest guide cards



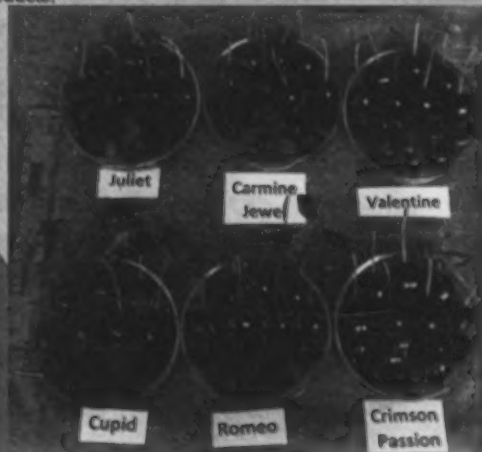
Sugar Content and fruit size info is also on the harvest guide card



Juice Samples on August 18th. Notice how dark Carmine Jewel juice is!



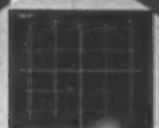
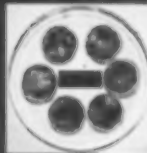
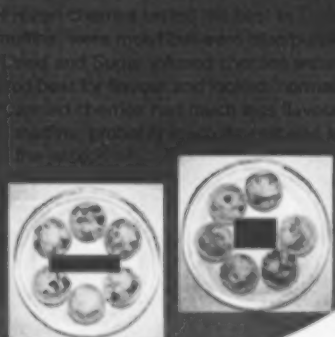
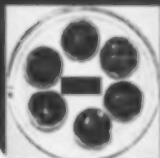
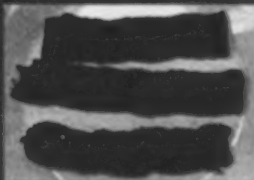
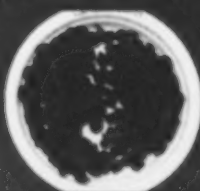
Juice is analyzed to determine which picking date was best



Cards were made for each cherry variety & will be available through the Canadian Cherry Producers Association



A week before and a week after optimum harvest time was Aug 18 to 25th. Fruit was at largest size & sugar content high.



Fruit colour changes for 6 varieties

Poster created by: Ellen Sawchuk & Bob Bors
Funding provided by: Agriculture Development Fund, Saskatchewan Ministry of Agriculture. A full report will be available on their website <http://www.agriculture.gov.sk.ca/ADF>
Many thanks to Volunteer Gary Holroyd